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TO STUDY THE EFFECT OF RUSSIAN CURRENT ON SHOULDER PAIN AND FUNCTION IN CHRONIC HEMIPLEGIC PATIENT

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ABSTRACT

Objective: This study aimed to investigate the effectiveness of Russian current on shoulder pain and function in chronic hemiplegic patient.

Methods: A experimental study was done with 30 patients divided in to two groups. Patient in group A (control group) and group B (experimental group) were assessed and informed consent were taken. Patient in group A were given 20 minutes conventional exercise therapy and in group B were given Russian current stimulation in addition of conventional exercise therapy program. Treatment was given for three times a week for 4 weeks. Data were collected by means of Visual Analogue Scale for pain and Upper Extremity Functional Index for shoulder function.

Result: After completion of 4 weeks treatment the post treatment mean values for VAS between group A and group B was 2.80±0.941 SD, 1.87±0.915 SD, respectively. And post treatment mean values for UEFI between group A and group B was 44.87±5.462 SD, 50.33±5.839 SD respectively.

Conclusion: Russian current stimulation along with conventional exercise therapy showed improvement in shoulder function and reduction of shoulder pain in chronic hemiplegic patient.

KEYWORDS: shoulder pain, post stroke, hemiplegia, russian current, physical therapy, shoulder function.

INTRODUCTION:

Stroke is a neurological disorder in which Motor deficits are characterized by paralysis (hemiplegic) or weakness (hemiparesis), typically on the side of the body opposite the side of the lesion.

Hemiplegia is a condition caused by brain damage or spinal cord injury that leads to paralysis on one side of the body. Hemiplegia can affect either the left or right side of your body. Whichever side of your brain is affected causes symptoms on the opposite side of your body. People can have different symptoms from hemiplegia depending on its severity. Symptoms can include muscle weakness or stiffness on one side, muscle spasticity or permanently contracted muscle trouble walking, poor balance, trouble grabbing objects. Strokes are one of the most common causes of hemiplegia.

Shoulder pain is a common and distressing complication of stroke, it interferes with both function and quality of life. From 16% to 72% of stroke patient develop hemiplegic shoulder pain,[1]

Shoulder pain is a frequent and debilitating symptom in hemiplegic patient. There are many factors that contribute to shoulder pain in hemiplegic patients, some are related to the neurologic erosion, such as the lack of sensibility and unilateral neglect. Other factors are related to the joint, such as lesion of the rotator cuff tendons reflex sympathetic dystrophy, spasticity, or shoulder subluxation.[2]

Cause of Painful Hemiplegic Shoulder:

(a) Shoulder subluxation: Shoulder subluxation occur when the mechanical integrity of the glenohumeral joint is compromised, the glenohumeral joint is multiaxial and has a wider range of motion than other joints, must relinquish a more stable bone structure and this lack is compensated by muscular stability, for the reason, a change in normal muscular function present a potential risk for subluxation. During the initial period following a stroke, the hemiplegic arm is flaccid or hypotonic. Therefore, the shoulder muscles are unable to anchor the humeral head with the glenoid cavity, resulting in a high risk of shoulder subluxation.[3] Shoulder subluxation is associated with pain.[4]

(b) Spasticity and contractures: Under normal circumstances, muscular balance is maintained between the different muscle pairs (agonist's, antagonists) following a stroke, muscular balance may be altered as muscles group effected by spasticity become dominant. This produces the typical postures that reflect a spastic muscle pattern.[3]

The downward traction that the dependent arm imposes may cause damage to all supporting structure of the shoulder. This condition has been associated with increased pain along with an increased incidence of inappropriate autonomic responses (i.e., sympathetic reflex dystrophy) in the upper extremity. The normal mechanism that protects the rotator cuff are lost in hemiplegia and this group of patients is also likely to have degenerative changes predisposing to rotator cuff rupture and result on shoulder pain. Paralysis of muscles activity and hypertonicity during the initial phase of stroke, predominantly to the supraspinatus and deltoid, overstretches the weak inferior capsule and ligament by the weight of the dependent arm resulting in pain. Instability of the shoulder joint is further worsened due to impairment of muscular and capsuloligamentous structures following stroke.[5]

Tobis describes the typical picture of Hemiplegic shoulder pain as flaccid paralysis, atrophic shoulder musculature and inferior subluxation, however Bobath claims that shoulder pain become a problem when spasticity develops.[4] Proper management of painful hemiplegic shoulder in stroke patient will allow them to participate more fully in neuro-rehab process and may therefore result in a better functional outcome.

Managing painful shoulder:

Positioning hemiplegic shoulder: Maintaining the upper limb in the correct position is fundamental to treating PHS. Careful positioning of the shoulder serves to minimize subluxation and eventually, muscle contractures as well.[3]

Physical therapy: Physiotherapy has been used in the treatment of hemiplegic shoulder pain.[6]

Electrical neuromuscular stimulation (ENS**)** Electrical neuromuscular stimulation consists of superficial application of electrical current, causing muscle contraction and increased muscle recruitment. The supraspinatus and deltoid muscles are the most commonly treated for PHS.[7]

More recently, Faghri and associates[18] described the effectiveness of functional electrical stimulation (FES) on shoulder subluxation, arm function recovery, and shoulder pain in hemiplegic stroke patients. These authors believed the FES overcame the painful hemiplegic shoulder because it is well known that the electrical therapy has a strong sedative effect on pain by acting on sensory nerves. A similar study claimed that at least 30 min of stretching was required to prevent contracture of joints and muscles in hemiplegic patients. Periarticular muscle strengthening exercise is needed to improve shoulder joint function in hemiplegic patients because the humerus head and scapula movements cannot resist gravity, generate incorrect mechanisms, and cause injuries of the periarticular soft tissue, neurologic pain, and dysfunction. A Study showed that the combined exercise therapy program of stretching and joint stabilization exercises for spastic shoulder joint dysfunction in post stroke hemiplegic patients reversed the pathological changes in tendons and improved shoulder function.[8]

Conventional physiotherapy is defined as the treatment of movement disorders caused by impairments of joints and the muscles that move the joints. Mobilization, strengthening and stretching constitute the three main treatment approaches in physiotherapy.

Russian current (medium frequency alternating current) is a type of electrical stimulation which has been advocated for use in increasing muscle force. It was originally developed for improving muscle strength in Russian Olympic athletes and was found to increase force gain up to 40% in elite athletes.[9] It was suggested that its use led to significant gain in muscle strength (about 30 – 40 %).

Russian currents were first invented by Y.M Kots during the 1977 Olympics to improve the performance of the athletes. Russian current is 2.5 kHz AC, applied in 50 Hz rectangular bursts with a burst duty cycle of 50%. The burst duration is 10 milliseconds at 50 Hz. Russian current is pretended to be helpful for increasing force-generating capacity of muscles. This type of treatment modality has been claimed to relieve pain in injured areas, increase local blood flow, strengthen muscles, cause muscle hypertrophy, and facilitate muscle contraction.[10]

The purpose of the present study was to evaluate if Russian current stimulation can improve shoulder pain and function in chronic hemiplegic patient.

MATERIALS AND METHODS:

This experimental study was done with 30 patients divided equally in the two groups, group A (control group) and group B (experimental group) both have 15 patients aged between 40 to 60 years with hemiplegic shoulder pain. Patient having medial cerebral artery involvement stroke and hemiplegia more than six months, patient with pain level of 4 to 8 as measured by Visual Analogue

Scale (VAS) and patient with decreased shoulder function assessed by Upper Extremity Functional Index (UEFI) were included in this study.

The whole procedure was explained to every patient and the informed consent was taken from them and require assessment was done. the measurement was taken a pre-treatment on 1st day and post-treatment on last of 4th week. The sensation was checked by the sensory exam includes testing for: pain sensation (pin prick), light touch sensation (brush), position sense.

Intervention:

Group A (control group): - conventional physiotherapy.[8]

✓ 20 minutes of conventional physical therapy in the form of**: -**

1. **Stretching:**
   - Arm-across-Chest Stretch.
   - Neck Release
   - The 90-degree, 90-degree Shoulder Stretch
2. **Range of Motion exercises:**
   - Shoulder abduction exercise
   - Active horizontal abduction exercise
   - Active shoulder external rotation exercise
   - Shoulder internal rotation

Intervention:

Group B (experimental group): (Russian current + conventional physiotherapy)

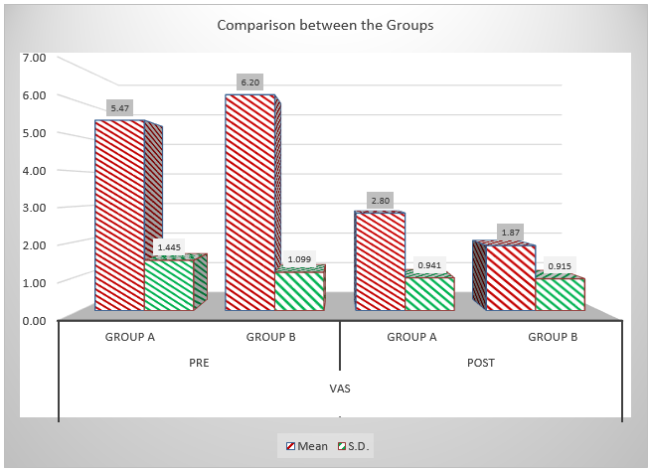
- 20-minute conventional physiotherapy in addition of Russian current stimulation, with the frequency of Russian current stimulation was 2.500Hz modulating 50burst/s with a pulse duration of 200ms.[11]
- The electrodes were placed over muscle belly i.e., on the anterior aspect & medial aspect of shoulder joint over Deltoid Muscle.[12]

DATA ANALYSIS AND RESULTS:

The analysis was carried out by using suitable tests with the help of IBM statistics package (SPSS-18) to verify the investigation of the study. Paired t test was used to find the difference within the group between pre and post intervention scores in the outcome measure. Unpaired t test was used to find the difference between the groups in the outcome measures. The statistical significance for this study was set as $p < 0.05$.

Table 1. showing the change in pre and post treatment values of mean, SD with t value and p Value in VAS between groups A and B.

Unpaired T Test	BETWEEN GROUPS			
	VAS			
	PRE		POST	
	Group A	Group B	Group A	Group B
Mean	5.47	6.20	2.80	1.87
S.D.	1.445	1.099	0.941	0.915
Number	15	15	15	15
Maximum	8	8	5	3
Minimum	4	5	2	0
Range	4	3	3	3
Mean Difference	0.73		0.93	
Unpaired T Test	1.565		2.753	
P value	0.1289		0.0102	
Table Value at 0.05	2.05		2.05	
Result	Not Significant		Significant	



Graph 1. Showing the change in pre and post treatment value of mean, SD with t value and p and value in VAS between groups A and B.

Both groups were showing significant difference when we compare within groups values for VAS, then we had compared between the group values, for that we had used t test.

The result of the test showed that there was no significant difference between group A, B before the treatment on score of VAS ($p = 0.1289$)

But when we compared the post treatment for VAS, by using t test, we had found that there was a significant difference ($p = 0.0102$) between group A and B, with mean values 2.80 ± 0.941 SD, 1.87 ± 0.915 SD, respectively. (Table.1)

This indicate that the Russian current stimulation in addition to conventional physiotherapy (i.e., Group B) have more significant than conventional physiotherapy (i.e., Group A) alone to decreasing shoulder pain in chronic hemiplegic patient.

Table 2. Showing the change in pre and post treatment values of mean, SD with t value and p value in UEFI between groups A and B.

Unpaired T Test	BETWEEN GROUPS			
	UEFI			
	PRE		POS	
	Group A	Group B	Group A	Group B
Mean	19.07	19.87	44.87	50.33
S.D.	5.574	6.116	5.462	5.839
Number	15	15	15	15
Maximum	30	30	55	60
Minimum	11	9	38	40
Range	19	21	17	20

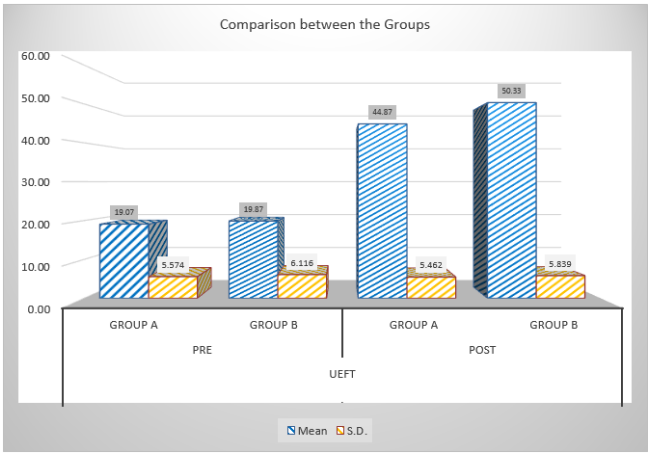
Mean Difference	0.80	5.47
Unpaired T Test	0.374	2.648
P value	0.7109	0.0132
Table Value at 0.05	2.05	2.05
Result	Not Significant	Significant

Both groups were showing significant difference when we compare within groups values for Upper Extremity Functional Index, then we had compared between the group values, for that we had used t test.

The result of the test showed that there was no significant difference between group A and B before the treatment on score of UEFI (0.7109).

Also, when we compared the post treatment value for UEFI by using t test, we had found that there was significant difference for UEFI (p = 0.0132) between groups A and B with mean value 44.87 ± 5.462 SD and 50.33 ± 5.839 SD, respectively. (Table 2)

This shows that the Russian current stimulation in addition to conventional physiotherapy (i.e., Group B) have more improvement than conventional physiotherapy (i.e., Group A) alone for increasing shoulder function in chronic hemiplegic patient.



Graph 2. Showing the change in pre and post treatment values of mean, SD with t value and p value in UEFI between group A and B.

Based on the above analysis we have found that Group B showed the greater improvement in decreasing Shoulder Pain and increasing Shoulder Functions.

DISCUSSION:

The present study was on attempts to find the effectiveness of Russian current in decreasing shoulder pain and improving shoulder function in chronic hemiplegia patient. And compared the result of group A & B and find which is more effective in reducing shoulder pain and improving shoulder function in chronic hemiplegic patients. 30 patients participated in the study that fulfilled the inclusion criteria. The study was conducted for duration of 4 weeks subjects were assessed for VAS and Upper Extremity Functional Index. It shows that patient treated with Russian current had significant improvement in decreasing shoulder pain and improving shoulder function in chronic hemiplegic patient.

Pain intensity significantly decreased in both groups. The reason for this reduction in pain was conventional physiotherapy treatment in the form of shoulder stretching, range of motion exercises act on the spastic shoulder muscles and rotator cuff of the shoulder which was affected after the stroke and reduced the spasticity of the shoulder muscles and improving function of shoulder joint.

But on comparison between the groups on VAS and UEFT, improvement was more in patient of group B who were treated with Russian current in addition to the conventional physiotherapy.

In the present study both techniques involve muscle work at significant intensity level result in muscle strength improvement. The finding of the muscles strength improvement with Russian current in present study work further supported by Anand B Heggannovae and Snehal R Dharmayat, International journal of Health and Rehabilitation in 2014, conducted a study to know the effect of Russian current on the quadriceps muscle strength in subject with primary osteoarthritis total 30 patient were included in this study divided in to 2 groups as n=15 for group A and n=15 for group who received Russian current as addition to SWD and exercise, VAS for pain measured before and after the treatment , likely Handheld Dynamometer for strength and WOMAC for functional disability were measured before and after the treatment end, after 10 days treatment the intragroup and between group comparison was statistically significant with p=<0.001 for both groups, it concluded that the Russian stimulation is effective in increasing quadriceps muscle strength and secondary improving the functional inability in subject with primary osteoarthritis of knee.13 Present study was further supported by Amr Almaz Abdel –Aziem, Emad Tauifik Ahmed, International Journal of Health and Rehabilitation Sciences in 2013 conducted a study to know the effect of Russian current stimulation on quadriceps strength of patient with Burn, total 40 subject were included in this study all of them were randomly allocated into two equal group (i.e.- control group and Russian group, control group received physical therapy in the form of splinting, massage, stretching Range of motion exercises , whereas Russian group stimulation in addition to physiotherapy treatment. Both groups were treated for 4 weeks day after day. after 4 weeks the quadriceps peak torque of Russian group and control group significantly increased (p=0.000), the post value of peak torque of Russian group was significantly higher than the post value of control group (p=0.010). the post value of ambulation speed of Russian group was significantly higher than the post value of control of this study was that the application of Russian current in addition to conventional therapy increase the quadriceps muscle peak torque and ambulation speed for patient with anterior thigh burn.11 This study further supported by Alex R Ward, Nataliya Shkuratova, Physical Therapy Journal of the American Physical Therapy Association, in 2002 did a review on the Russian Electrical Stimulation: The early experiments,9 it provides the details of the original study by Kots and co-workers, the author contended that these studies laid the foundation for the use of Russian form of electrical stimulation in physical therapy.

CONCLUSION:

The conclusion of this study is that Russian current stimulation is effective in increasing shoulder function and decreasing the shoulder pain in chronic hemiplegic patient. It can be added as an adjunct to the existing protocol for management of shoulder pain in chronic hemiplegic patient.

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